Remarks

In view of the foregoing amendments and these accompanying remarks, it is respectfully requested that this application be reconsidered.

Claim 28 has been amended to more particularly point of the invention and the points of novelty. These points include the casing acting as a pressure applying spring, electrodes which are non-sintered and non-glued and a separator which is multilayered and will allow only the working ions to pass.

The case must exhibit greater flexibility then a rigid body. The case must be able to expand and contract as needed to apply sufficient pressure to the particles to maintain close contact during charging and discharging without crushing and deforming the electrodes. A rigid body is incapable of the required flexibility.

The particles of the electrodes must be free to move in relation to each other thus there can be no foreign matter hindering this movement as would occur if the particles were glued, sintered or otherwise held together by adhesives.

The separator is designed as multi layered to allow higher strength, controlled swelling and permeability of the working ions of the cell. Due to the expansion of the electrodes during charging and discharging the separator experiences stresses which present paper and single layered separators cannot withstand. Further, the multiple layer permits a thin high strength permeable layer to be combined with lower strength reduced permeable layers that may be tailored to the particular ions allowed to pass.

Other amendments have been made to further define these elements in the dependant claims.

Claim 46 has been amended as suggested by the Examiner, but Applicant believes that the amendment is completely unnecessary. When referring to elements of the Periodic

Table, it is not uncommon to use a capitalized first letter, as is done throughout this application and the claims. Therefore, "silver" may be written in the claims with either a capitalized first letter or a non-capitalized first letter and it would be correct.

Applicant respectfully disagrees with the rejection based on Yardney (US Patent 2,812,376) and believes that Yardney does not anticipate the claimed Invention.

As claimed herein, the invention requires "at least one of said electrodes including an electrically conductive substrate and compressed particles of an active material deployed on said substrate." Yardney, on the other hand, does not disclose either electrode being made of "compressed particles of an active material deployed on a substrate," but, rather "of zinc-oxide and silver, respectively. (Page 3, lines 46- 65) Accordingly, Yardney is not dealing with the same construction of battery, as the electrodes structure is clearly different.

Moreover, as claimed herein, the invention requires "an elastic means applying pressure on each of said electrodes during charging and discharging of said cell so as to maintain close contact between said particles themselves and between said particles and said substrate to counteract periodic changes to the electrode's volume resulting from electrochemical reaction between the electrolyte and the active material taking place during charging and discharging of said cell." It is impossible for Yardney to teach or suggest a means to maintain contact between the particles and the substrate if Yardney does not even mention or suggest a substrate.

The invention refers to a secondary type (i.e. rechargeable) battery of a Silver-Zinc system, which utilizes electrodes made out of compacted granules of powder of active materials not sintered nor glued. The powdered active materials are used in order to achieve the increased specific active surface. As a result, an increase of the specific capacity will be obtained. Within the electrode, particles are embedded in a conductive substrate, which could be made out of metallic grid.

The electrodes are isolated by flexible separator system without leaving any clearance between the electrodes and separators.

The electrodes are installed in a metallic casing filled with an electrolyte, the ions of which can diffuse through the pores of the separators to approach the particles of the active material and thus to allow the electrochemical reaction to take place during charging and discharging of the cell. The electrodes can be in a flat or spiral (wound up) configuration. One of the objects of the invention is to ensure close contact between the granular or powder particles and between particles and the substrate during charging and discharging of the cell without sintering or gluing of the particles. To achieve this object, the battery cell employs an elastic mechanical means capable of exerting pressure directly on the electrodes to ensure close contact between particles of the active material themselves and at the same time close contact between the particles and the substrate. In one embodiment of the invention, this elastic means is a spring, which embraces the electrodes as shown in Fig.1. In the other embodiment, this means is the battery cell's walls themselves, which are designed to be sufficiently elastic to apply pressure to the electrodes. In practice, this elasticity should be sufficient to ensure contact pressure of at least 0.2 kg/cm2. This feature is supported by the description.

The embodiment in which the cell walls serve as a means for applying pressure has an advantage, since this arrangement does not require a dedicated spring means to be placed within the cell. Accordingly, the inner volume of the cell is more efficiently used and the cell is more compact.

Furthermore, one should keep in mind that, during periodical charging and discharging of the cell, the active material undergoes chemical changes. Since these changes are accompanied by a change of density (bulk & absolute), the electrodes periodically change their volume. Due to the volume changes, there is a danger that the structural integrity of the electrodes will deteriorate and accordingly the electronic conductivity will be reduced, as well as the cell's efficiency. The present invention seeks to

compensate for these volume changes and prevent the danger of structural deterioration. The elastic walls of the cell are adapting themselves to the periodical volume changes and ensure that during charging and discharging there is always a required contact being maintained in order to provide the contact between particles of the active material and the respective substrate.

In one of the embodiments, the separator is made of cellophane, which swells in the electrolyte and thus exerts additional pressure on the particles of the active material. However, it should be kept in mind that according to the invention the separator should not necessarily be made of a material, which swells.

Claim 28 does not mention features, which are present in Yardney, like the partition, for example. Claim 28 neither mentions a partition, nor pressure exerting means inserted in the casing and capable of exerting pressure on one side of the partition.

On the other hand, claim 28 mentions features, which are not present in Yardney. Among those features claim 28 mentions are electrodes made of an electrically conductive substrate and of compressed particles deployed on said substrate. Yardney neither discloses substrates associated with the electrodes, nor discloses electrodes made of compacted particles of an active material deployed on the substrates. Yardney only very briefly mentions that active material of the electrodes may be sintered (column 3, lines 57, 58). One can understand from this that electrodes of Yardney are monolithic bodies, which have been consolidated by sintering. In contrast to Yardney, electrodes of the invention consist of granules of powder particles, which during manufacturing are only compacted, but neither are sintered, nor glued, nor consolidated by any other method, therefore electrodes employed in the present invention are not monolithic bodies. When immersed in electrolyte, these electrodes become a slurry held within the separators. This point is significant, since it explains the differences in the problems, which Yardney and the present invention seek to solve and accordingly the difference in the solutions, which Yardney and the present invention employ.

Since the electrodes of the invention are not monolithic and since they become slurry when immersed in the electrolyte, it is necessary to ensure contact pressure between adjacent particles of the active material. The swelling problem and associated with it variation of cellophane pressure-versus-thickness ratio, which is the concern of Yardney, is not a concern of the present invention. The present invention provides a solution for achieving the required contact pressure irrespective whether the cell employs a swell able or a not swell able separator. The present invention achieves its object by providing the cell either with elastic walls capable of exerting pressure immediately on both electrodes or with a spring, embracing both electrodes. The elasticity of the walls or of the spring should be sufficient to achieve contact pressure of at least 0.2 kg/cm2. This particular solution has also an additional advantage, since it renders the cell more compact.

The object of Yardney is quite different. Yardney seeks to compensate for the reducing of pressure asscoaited with swelling of the separator due to a change of the pressure-versus-thickness ratio. This reducing of pressure is associated with fatigue of the cellophane. Yardney is not concerned about contact pressure between particles of the active material, since it employs sintered electrodes, which remain monolithic within the electrolyte. Yardney provides a particular solution, which is relevant only to cells, which employ swell able separators. The solution comprises placing a movable partition in the cell, which divides the cell into two compartments, i.e. the electrode compartment and the pressure compartment. A set of springs is deployed in the pressure compartment between a stationary plate adjacent the casing wall and the partition. By virtue of this provision the movable partition is under pressure, which is exerted by the movable partition on the electrodes to compensate for the variation of the pressure-versus-thickness ratio of the cellophane separator.

One should keep also in mind that the solution of Yardney necessitates using additional elements (partition, spring, stationary plate). Since these elements require room, the working space of the cell is used less efficiently.

Regarding claims 31, 34, 42, 43 and 45 one should keep in mind that these claims are dependent claims and therefore are new so far as claim 28 is not anticipated.

Regarding claim 41, the casing per se does not act as the specific pressure applying means and Yardney's casing does not exhibit any degree of elasticity.

In Yardney the pressure is applied by a spring, which is located intermediate between the casing and the movable partition. One can readily appreciate that in order to make this arrangement operable the casing is expected to be rigid and not elastic, otherwise there would be no proper reaction force for the displacement of the partition. Yardney indeed mentions the casing of relatively rigid preferably plastic material (column 3, line 47). In the present invention the cell walls are deliberately made elastic and not rigid. The degree of elasticity is selected to achieve contact pressure of at least 0.20 kg/cm2.

Therefore, the rejection under Section 102 should be withdrawn as Yardney does not anticipate the claimed subject matter.

One should bear in mind that claims 29, 35-37 are dependent claims and are patentable as claim 28 is new and not obvious. As shown above Yardney does not anticipate claim 28.

As to alleged combination of Yardney with Devitt (US Patent 3,669,746), neither Yarney nor Devitt explicitly or implicitly mention any incentive, motivation or suggestion to combine their teachings.

Furthermore, claims 29 and 37 of the present invention define a flexible substrate. Yardney discloses rigid electrodes and does not disclose a substrate at all, therefore any teaching of Devitt concerning electrodes stacked on a flexible substrate would be irrelevant to Yardney and there would be no reason to combine the teachings of Yardney and Devitt.

Furthermore, Devitt mentions stacking pressure, which is applied during manufacturing of the electrodes before they are placed in the cell. Devitt does not teach

use of a pressure applying means for exerting pressure on electrodes during service of the cell as in Yardney. Therefore, this is another reason why there would be no motivation to combine Yardney and Devitt.

As to claim 35, it would be not obvious to combine a spirally wound cell as disclosed in Devitt with the pressure applying arrangement of Yardney.

The reason for this lies in the fact that such an alleged combination would not bring about the claimed invention, because a flat movable partition is not suitable for applying pressure on a circular wound electrodes tightly inserted within a tubular container.

Devitt speaks about stacking pressure, which should be ensured during the manufacturing of the electrodes. Devitt does not suggest exerting pressure on the electrodes after they have been inserted in the cell.

As to claim 36, this claim is not obvious, since due to the above reasons Devitt is not combinable with Yardney.

Dews (US Patent 3,912,538) is not combinable with Yardney.

The reasons for this are as follows. Neither Yardney nor Dews contains any explicit or implicit teaching, suggestion or incentive supporting the alleged combination.

Furthermore, such a combination would not be feasible, since Dews employs an electrode made from graphite particles, which are embedded in a flexible substrate made from carbon fiber, whereas Yardney employs a rigid, monolithic electrodes made of sintered particles. Yardney does not disclose a substrate at all, not to mention a flexible substrate made of carbon fiber.

Thus, the alleged combination of Yardney with Dews does not preclude the patentability of claim 28. Claims 29-30 depend on claim 28 and are patentable, since claim 28 is patentable.

Ruetschi (US Patent 4,192,914) is not combinable with Yardney.

The reasons for this are as follows. Neither Yardney nor Ruetschi contains any explicit or implicit teaching, suggestion or incentive supporting the alleged combination.

Furthermore, such a combination would destroy the intended function of Yardney, since Yardney discloses a battery of a secondary type, i.e. rechargeable, while Ruetschi discloses a battery of a primary type, i.e. dischargeable.

Thus, the alleged combination of Yardney with Ruetschi does not preclude the patentability of claim 28. Claims 32-33, 46 depend on claim 28 and are patentable, since claim 28 is patentable.

Ferrando 1 (US 5,045,349) and Ferrando 2 (US 5,283,138) are not combinable with Yardney.

The reasons for this are as follows. Neither Yardney, nor Ferrando 1or 2 contains any explicit or implicit teaching, suggestion or incentive supporting the alleged combination.

Claims 38-39 define a substrate made of a flexible graphite fiber coated with a metal coating and having a certain thickness.

Yardney does not disclose a substrate. Ferrando 1 and 2 disclose silver-nickel cathodes, which are made of discrete nickel particles, adhered to a substrate made of graphite fiber.

Thus, it would not be obvious to combine Yardney with Ferrando 1 or 2 in order to provide Yardney with a substrate, since Yardney does not disclose a substrate.

Furthermore, Ferrando 2 discloses a lightweight zinc electrode, which is made of a flexible support grid, hosting therein a zinc active composite material. The grid is made of a sintered mat or copper metal coated graphite fibers and the active material is pressed or injection molded into the fiber mat so that the composite material is attached to and

surrounds the fibers. In other words, the electrode of Ferrando 2 consists of discrete particles attached to a substrate. The electrodes of Yardney are monolithic and do not contain discrete particles.

Claims 38 -39 depend on claim 28 and are patentable, since claim 28 is patentable.

Ferrando 1 is not combinable with Yardney and with Mansfield (US Patent 5,306,580).

The reasons for this are as follows. Neither Yardney, nor Ferrando 1, nor Mansfield contains any explicit or implicit teaching, suggestion or incentive supporting the alleged combination.

Claim 40 defines a coating on the cathode substrate. Yardney does not disclose a substrate and is not combinable with Ferrando 1. Yardney is not combinable with Mansfield since Yardney employs a monolithic electrodes, while Mansfield employs an anode made of loose particles.

Furthermore, the alleged combination would destroy the intended function of Yardney or Ferrando 1, since Yardney and Ferrando 1 disclose a secondary type battery, i.e. rechargeable, while Mansfield discloses a battery of a primary type, i.e. dischargeable.

Pauling (US Patent 6,207,316) is not combinable with Yardney. The reasons for this are as follows. Neither Yardney, nor Pauling contains any explicit or implicit teaching, suggestion or incentive supporting the alleged combination.

Furthermore, there is no reason for such a combination, since the polyethylene and polypropylene separators of Pauling do not swallow and therefore it would be meaningless to provide the cell of Pauling with the pressure arrangement of Yardney, which has been designed specifically for the cell with swell able separators.

Therefore, for all of the above reason, the claimed subject matter is not obvious and

the rejections under Section 103 should be withdrawn.

Therefore, all the pending claims are novel over the cited prior art and not anticipated or obviated, and the rejections under 35 USC 102 and 103 should be withdrawn.

It is, therefore, requested that a Notice of Allowance issue and that all of the pending claims be allowed.

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Respectfully submitted,

Lilling & Lilling P.C.
Customer No. 24101

By /Sean Liam Kelleher/
Bruce E. Lilling
(Reg. No. 27,656)
Sean Liam Kelleher
(Reg. No. 54,212)
P.O. Box 560
Goldens Bridge, New York 10526
Phone (914) 684-0600
Facsimile (914) 684-0304
Bruce@Lilling.com
Sean@Lilling.com